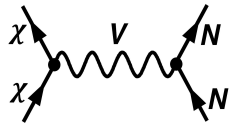
# Super Cryogenic Dark Matter Search

*Experiment to detect collisions of Dark Matter WIMPs onto atomic nucleons*

## The Experiment

## The Toy Model

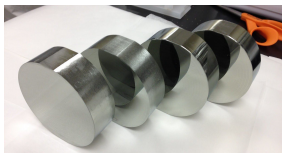
### Weakly Interacting Massive Particle (WIMP) = Nerf Dart

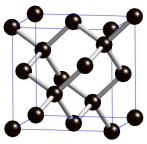



- Expected WIMP mass: ~1 proton; ~$10^{-27}$ kg
- WIMP speed: ~300,000 m/second
- WIMP density: ~1 WIMP per 3 $cm^3$
- Number of WIMPs passing through a detector, per second: ~600,000,000
- WIMP impact cross-section area: < $10^{-43}$ $cm^2$
- Number of WIMPs needed for 1 hit of a target atomic nucleus: > $10^{26}$
- Expected WIMP hit rate: < 1 per year
- Energy deposited by 1 hit: ~$10^{-16}$ J
- Number of WIMPs passing through a person, per second: ~10,000,000,000

- Nerf dart mass: 1 gram = $10^{-3}$ kg
- Nerf dart speed: ~10 m/second
- Number of Nerf darts passing through the target, per second: ~0.2
- Nerf dart cross-section area: 1 $cm^2$
- Number of Nerf darts needed for 1 hit of the target: ~3
- Expected Nerf dart hit rate: ~4 per minute
- Energy deposited by 1 Nerf dart hit: ~0.1 J
- Number of Nerf darts passing through a person, per second: 0

### SuperCDMS Detector = Model Target





- Detector nucleon mass: ~$10^{-27}$ kg
- Detector atom separation:
  - Silicon (Si): 2.35 x $10^{-10}$ m
  - Germanium (Ge): 2.45 x $10^{-10}$ m
- Number of atoms per detector:
  - Si: 1.3 x $10^{25}$; Ge: 1.1 x $10^{25}$
- Detector Size: 10 cm diameter x 3.3 cm H
- Detector Mass: Si: 0.60 kg; Ge: 1.38 kg
- Detector Temperature: +0.05 K = −459.6 °F
- Detector Vibration Frequency: > $10^{12}$ Hz
- Underground Depth of Detectors: 2070 m

- Target atom mass: 4 grams = 4 x $10^{-3}$ kg
- Target atom separation: 52 mm
- Target atom size: 23 mm diameter
- Number of target atoms: 120
- Target Size: 36 cm W, 40 cm H, 18 cm D
- Target Mass: 0.6 kg
- Target Temperature: ~70 °F = +294 K
- Target Vibration Frequency: ~2 Hz
- Underground Depth of Target: 0 m

**https://supercdms.slac.stanford.edu/**